light is necessary for the synthesis of albuminoids in the higher green plants, and probably in all green plants, but that amides are produced in limited quantities in darkness and in parts of the plants which contain no chlorophyll. The lower plants devoid of chlorophyll can manufacture albuminoids in darkness, the necessary energy in this case being derived from the decomposition of organic compounds.

The twenty-third volume of the *Agricultural Journal* of the Cape of Good Hope is now being published in monthly parts by the Department of Agriculture, Cape Town. Though not new, the *Journal* has recently altered and improved its form, and this sixpenny monthly may be commended to the notice of all who are interested in the agriculture of South Africa. Prospective settlers would find many useful hints in it, for by means of editorial notes, special articles, and correspondence the *Journal* gives a clear presentation of the condition of the various farming industries of Cape Colony. Diseases of live stock are very common in the colony, and young men preparing for life on a South African farm should endeavour to gain some knowledge of veterinary hygiene before going abroad. The *Journal* usually devotes one or two articles in each number to veterinary subjects and the ailments of stock bulk largely in the correspondence columns. A correspondent from Aliwal North, writing in the October number, makes an observation which is interesting in view of the importance of ticks as carriers of disease germs. He reports that he had a flock of goats badly infected, but " happened to drop " on a cure in the shape of wild garlic. He gave the affected animals a small quantity; the ticks were not killed, but they dropped off the goats, and no further loss was suffered. Next year, when the tick season came round, the goats escaped injury.

Regulations for the purpose of preventing the importation of plant pests have been in force in Cape Colony for a number of years, but experience has shown greater caution to be necessary, and after January 1, 1904, new and stringent regulations will come into force. With the view of preventing inconvenience and loss to exporters, wide publication has been given to the altered regulations. The following points are of special interest to horticulturists:—(1) All plants or parts of plants not grown in South Africa must in future be sent to Cape Colony by sea. Imported plants must not be sent overland from other colonies. (2) Certain plants are absolutely prohibited, as, for example, stone-fruits from the U.S.A. and Canada, and peaches from any foreign country. (3) Permits are granted for the importation of small quantities of fruit trees from most countries, so that stocks of new varieties may be worked up in the colony. (4) Plants will be examined on landing by a competent officer, thus minimising the risk of importing pests. Trees and woody plants will be fumigated, the expense of fumigation being borne by the consignee. Any plants or parts of plants on which the examining officer finds a specially dangerous pest will be destroyed without delay.

BUDDHISM.[1]

THE appearance of the first number of a new quarterly magazine entitled *Buddhism* is an event of some significance, for it argues that the modern tendency of western inquiry into the ethics of this ancient eastern faith is sufficiently active to justify a commercial venture.

The object of the review is stated to be, first, to set before the world the true principles of the Buddhist religion; secondly, to promote certain humanitarian activities enjoined by Buddhist precept; and, thirdly, to unite, " as by a common bond of mutual interest and brotherhood, the many associations with Buddhist aims which now exist."

These objects are well sustained in the initial number of the review. It opens, most appropriately, with a poem by Sir Edwin Arnold, whose " Light of Asia " has probably done more to popularise Buddhism in the west than any literary effort hitherto known. It continues with a series of essays by Buddhist writers, in which the doctrines of Buddhism are explained and advocated with much earnestness, and, on the whole, with an intelligent appreciation of the limitations of ordinary human understanding; and it includes notes and references which sufficiently prove what an active agency in the practical world Buddhism is becoming. Amongst the notes is an invitation to western students to join the great brotherhood of the Yellow Robe, with a very explicit statement of the conditions under which candidates will be accepted. " Bhikkus of occidental nationalities " are first invited, " who in due time would be able to return to their own countries, there to spread the knowledge of Buddhism "—in short, missionaries. Amongst these Bhikkus there may be some who may be willing to take the Robe, but they are candidly warned that the conditions of life in the order are " somewhat severe for occidentals."

All this is practical business, and it leaves an impression that the review fills a space in the ranks of modern Oriental literature which is distinctly open to enterprise.

The article on the " Faith of the Future," coupled with that on " Nibbana " (Nirvana), is a clear and intelligible exposition of the gospel of law and self-culture inculcated by Buddhism, and is, perhaps, a clearer analysis of the final conditions of nebulous existence which crowns and completes the strenuous life of the Buddhist than can be found in most theological treatises on the Christian's hereafter. Based on the unsafe assumption that the " destructive fire of science " has annihilated revealed religion, it offers the alternative of the old world ethical system which is not founded on revelation at all—" the system of ontology founded on reason rather than belief "—which advocates the culture of the highest faculties of the mind; and teaches man that, avoiding all vain speculations about God and the soul, or his future self-conscious identity, he should concentrate his attention on existence as he finds it, and learn that all evil springs, not from the life without, but from the heart within, its cravings and its desires. " The attainment of true and lasting happiness is for him alone who from his own being shall eradicate the Cause of Sorrow, shall free his heart from all this grasping at straws in life's fierce waters, and from all this thirst after its false salt waves. And the way in which this may be done . . . is Truth the Fourth," &c.

The writer of the essay would do well to avoid overstating his case. It is not the fact that Buddhism has done more towards civilising the world than any other religion, nor can the proposition be unconditionally accepted that it has added more towards increasing the great sum of human happiness and peace than any other; for it is an indisputable fact that in this imperfect world (so slowly developing towards more perfect ends through the agency, not of one, but of all reasonable religions) war has, after all, been the great civilising agent, the cleansing and purifying principle which has age after age reconstructed higher forms of civilised existence on the ashes of destroyed communities. And war is wholly and absolutely obnoxious to Buddhist principles. As for the peaceful and happy conditions of such nations of the world as still recognise the gentle rule of the Buddhist priest, we may still be open to serious doubt. The Burmese, truly, are a light-hearted race—but is this due to self-culture, or environment? In Ceylon, alas! virulent family dissensions ending in crime are (or were but a few years ago) peculiarly frequent.

It is, however, impossible to do more than note the general character of the review. It is well written (there are two delightfully descriptive articles on " The Woman of Burma " and the " Shadow of the Shwe Dagon "), well printed, and well illustrated, and will do much to familiarise the European reader with the active principles of an eastern faith which is older than Christianity, and is professed by 500 millions of his human contemporaries. In the modern world of free thought and toleration such a magazine as this should be welcome, and it would not be surprising if it attained a wide circulation.

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[1] *Buddhism*, an Illustrated Quarterly Review. (Printed and published for the International Buddhist Society by the Hantnawaddy Printing Works, Rangoon, Burma.)

TECHNICAL EDUCATION IN GERMANY.

THE excellence of the German system of higher scientific and technical education has been referred to in many articles which have already appeared in NATURE, and the lavish endowment by the State in Germany of the institutions in which the education is given was dealt with in our issue for March 12 (vol. lxvii. p. 433). We are glad to find that public attention is being again directed to the same subject by the *Times*, and that an exhaustive comparison

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between the supply of technical education in this country and in Germany was made in a valuable article which appeared in the issue of that journal of November 9.

Most of the English technical schools have, says the writer in the *Times*, for their principal object the teaching of actual industries. In Germany, on the other hand, the term has come to be associated more and more with pure knowledge, and is now commonly reserved for those advanced academies which teach the science underlying industries, but not the industries themselves. What we generally call technical schools are in Germany called "Fachschulen," or Gewerbeschulen, that is, "trade schools," which fall into two main groups. The first group provides instruction for apprentices in the hand trades and for artisans, and may be called "lower trade schools." The second group is large and of great direct importance to the manufacturing industries. The "technical schools" in our large manufacturing towns correspond most nearly to these institutions, which may be called "higher trade schools." Then above these is the highest class, namely, the "technical high schools," which do not correspond to any of our educational institutions. This classification gives a clear view of the special educational provision for industrial life in three broad divisions:—(1) ordinary workmen; (2) those above the grade of workmen from foremen to manufacturers; (3) the high scientific experts, consultants, and innovators.

The main differences between the higher trade schools and the corresponding English technical schools are two—they are more specialised, and are chiefly intended for and used by superior students. There is some provision for workmen, but, as a rule, comparatively little advantage is taken of it. The classes proper are held in the day, and cannot be attended by men at work; those thronged evening lecture-rooms and laboratories filled with young fellows out of the factories and workshops which may be seen in any large manufacturing town in England are almost unknown in Germany. The real meaning of this is that the English schools cater for students in a lower rank of life and teach a much larger number of subjects. The German schools of this class, on the contrary, are quite clearly differentiated. They are not quite so restricted as the description applied to them suggests. The "weaving" schools, for instance, generally embrace all the main textile processes. But they are strictly devoted to some special branch of industry, and their main function is to enable students, who are to occupy superior positions, to acquire a thorough mastery of the skilled processes. Our own textile schools do excellent work, and, so far as affording opportunities to the working classes is concerned, they do far more than the German ones, but they do not command the same superior material. The reason for this is that there is not yet the same inducement to young men who have had a superior liberal education to take up the career of manufacturers' expert. This fact is really at the bottom of the question of scientific education. Given the demand, the supply will follow. The lesson to be learnt from Germany is to make industrial science a sufficiently attractive career for those who have received a superior general education, and particularly a full classical one. The Germans have no belief in the American plan of teaching trades wholly in schools. With regard to finances, these schools are supported by fees, endowments, municipal and State grants, but the general tendency is towards more and more State support and State control.

The technical high schools, of which there are nine, with two more in preparation, represent a further step. As the superior grade of trade schools has been developed from a lower, so the high schools have been developed from trade schools to meet still higher requirements. They have the *status* of universities, are self-governing, and do for the industrial professions what the universities do for the learned professions—that is, impart the highest training in those principles which form the theoretical groundwork of practice. The technical high schools do not supersede or overlap the universities: they supplement them.

The technical high schools have no uniform curriculum, but all of them teach architecture, civil and mechanical engineering, chemistry, mathematics, and physical science. Exceptional subjects are naval architecture (Berlin), mining (Aachen), forestry (Stuttgart), agriculture (Munich). Pharmacy is taught at Brunswick, Karlsruhe, and Stuttgart, and at the last there is a railway, post, and telegraph course. Previous practical knowledge is generally required, as in the trade schools, and more rigidly insisted on. The high school is even less than the trade school a substitute for apprenticeship.

The two really important departments of the technical high schools are chemistry and electrical engineering. It is impossible to exaggerate the importance of the first; it enters into every branch of manufacture, and becomes more potent every day. At the high school teaching and experiment are pushed to the furthest theoretical limits, and the value to Germany is incalculable. Her chemical industries are reckoned to bring in fifty millions a year, but the application of chemical knowledge goes far beyond that and extends into a thousand channels. Nor can any man tell what it may bring forth to-morrow. This is the great lesson in industrial science that the high school has to teach. But it must not be forgotten that chemistry can be, and is, equally well taught at the universities. So, too, electrical engineering, which has also been of immense value to Germany; but her rapid industrial advance in that line, compared with ourselves, is due less to superior knowledge than to the gratuitous retardation of the home industry by Government regulations.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, December 11.—Mr. James Swinburne, vice-president, in the chair.—A method of mechanically reinforcing sounds, by the Rev. T. C. **Porter.** If a tuning-fork be sounded and placed in a flame, there is a very marked reinforcement of the sound. This is proved not to be due to resonance in the ordinary sense, but to the change from continuous to intermittent combustion. In certain circumstances the impulses given to the air external to the flame, by the waves of burning gas, are more forcible than those given by the unaided sounding body. Thus a new way of reinforcing the sounds given by a vibrating body is found, and the rest of the paper demonstrates this for the phonograph, a *flame* being used instead of the ordinary *trumpet.* Coal-gas and air are brought by tubes into the chamber of the "reproducer" and thence to a jet, where they are burnt. The vibrations of the reproducer are thus impressed on the issuing gas and air, which burn synchronously with them, the sounds thus emitted being easily heard over a large room. In practice it is found best to spread out the flame by a second jet of air, or of mixed air and gas, placed close to the first jet and at right angles to it. The author describes the nature and quality of the sounds emitted by the flame, and the modifications of these which may be produced.—The Simmance-Abady "flicker" photometer, by Messrs. **Simmance** and **Abady.** The principle of the flicker photometer, discovered by Prof. O. N. Rood ten years ago, has frequently been remarked on, but attempts to design a trustworthy apparatus depending upon this principle have hitherto been unsuccessful. The authors, guided by the following rules, have designed a photometer which is capable of balancing and comparing the most violently contrasted tints:—The light-effects must be in juxtaposition without any apparent division line, and must move, oscillate, or rotate so that the point of juncture of the rays of the two lights passes and returns entirely across the vision field. Any hiatus, or longer exhibition of one light than the other, biases the result. The observation surfaces, or surfaces upon which the light rays fall, must be at exactly the same distance from the eye, at exactly the same angle in relation to the line of sight, and must be of pure white, such as is afforded, for example, by a clean chalk, plaster of Paris, magnesium carbonate, or barium sulphate; any tint affects the accuracy of the result. The observation surfaces must also themselves in turn occupy the field of vision; an apparent movement or optical illusion does not afford accurate results.—Mr. Rollo **Appleyard** exhibited a "conductometer" the theory and mechanical details of which are fully described in the *Proceedings* of the Institution of Civil Engineers, vol. cliv., session 1902–3, part iv.—Prof. L. R. **Wilberforce** exhibited

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